Policy instruments for curbing CO2 emissions

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Published in:
Environmental and Resource Economics

Publication date:
1993

Policy Instruments for Curbing CO_2 Emissions: The Case of The Netherlands[1]

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Abstract. Taxes may seem to be the most attractive instrument for curbing the emissions of carbon dioxide. This paper, however, argues that environmental taxes involve a number of serious complications — especially in an open economy riddled with market imperfections like the Netherlands. Therefore, a wide-ranging policy mix is called for. As far as households and sheltered sectors are concerned, regulation can continue to play a major role. Within the context of unilateral policies aimed at exposed sectors, the combination of subsidies and voluntary agreements may be more cost effective than the tax instrument.

Key words. Energy conservation, environmental taxation, open economies, second best, international coordination.

1. Introduction

Energy conservation plays an important role in cutting the emissions of CO_2. Nevertheless, the distinction between the objectives of, on the one hand, curbing pollution and, on the other hand, conserving energy is important because an improvement in energy efficiency does not necessarily imply a reduction in pollution. Indeed, if the objective is to cut CO_2 emissions, the base of an environmental levy on fossil fuels should be carbon content rather than market value or the energy content. With this base, a carbon tax encourages the substitution of carbon-poor for carbon-rich fuels. In fact, fuel subsitution may allow a cut in CO_2 emissions without reducing the overall use of energy.[2]

This paper assumes that the policy objective is not so much to economize on energy as to reduce pollution — and in particular to curb the emissions of carbon dioxide (CO_2) in order to contain the greenhouse effect. It analyzes a number of environmental policy instruments pertaining to fossil fuels, mainly in the context of the Dutch economy. Most of the arguments, however, are also relevant for other open economies, such as the other EC members and the Scandinavian countries. On the menu are the following instruments: regulation, subsidies, voluntary agreements with industry, and taxation. At the moment, most industrial countries, including the Netherlands, rely almost entirely on the first three instruments.

More recently, however, policymakers have shown a growing interest in environmental taxation. Some economists have even gone so far as to argue

Environmental and Resource Economics **3**: 233—244, 1993.

that environmental policy should rely entirely on the tax instrument. The theory that taxation is always and everywhere the best instrument assumes, however, perfect markets and a closed economy. The Netherlands is an extremely open economy. Moreover, most economies, including the Dutch one, are riddled with market imperfections. Hence, policymakers confront a case of the second best. This implies that in selecting policy instruments, they have to resort to a more pragmatic "case-by-case" approach. Indeed, several policy instruments can play a role.[3] A diversified diet, in other words, is advocated. Taxation, as a matter of fact, is part of that diet. Indeed, Section 2 explores a number of important advantages of the tax instrument. Section 3, then, discusses a number of problems if a small open economy like the Netherlands would unilaterally adopt such a tax, especially if that tax would include energy-intensive firms that are subject to international competition. In this connection, some alternative policy instruments are analyzed in Section 4. Section 5 proceeds by investigating the case of international coordination and explores the conditions under which coordinated taxes could be successful. Section 6 analyzes policies targeted at households and at firms that are not subject to international competition.

2. Taxation: The Advantages

Economists rightly put forward a number of major advantages of taxation.[4] In particular, in internalizing the external effects of pollution, taxes leave the private sector free to decide how and when pollution is curbed. Hence, they rely on the knowledge and creativity that is available at the decentralized level. Taxes tend to be cost-effective, also, because they equalize the marginal costs of cutting pollution across the various polluting sources. This ensures that pollution is cut where it is cheapest to do so. Moreover, a permanent incentive is provided to develop new technologies that are less damaging to the environment. Hence, taxes are efficient in a dynamic sense. Another advantage is that taxes discourage entry to the industries that are relatively polluting. Accordingly, they accelerate the desired structural change of the economy in a less environmental-intensive direction. Furthermore, the administrative costs of collecting the environmental levies may be relatively small if the existing system of tax collection can be relied upon. The final advantage of environmental levies is that the revenues can be used to reduce the adverse effects of these levies on equity or international competitiveness of selected sectors. This may be especially important for taxes on fossil fuels. The wide tax base, together with a rather low price elasticity, implies that such taxes can yield substantial revenues. In the Netherlands, distortions in the labor market and the low participation rate in the labor force are of major concern. Hence, using the revenues from environmental levies to reduce taxes on labor income seems rather attractive. Section 5 returns to this last argument because there are some important caveats here.

3. Unilateral Taxation and Energy-Intensive Exposed Sectors

At first sight, taxation seems an attractive instrument indeed. In practice, however, the Netherlands faces a number of complications. One fundamental problem for a small open economy is that foreign countries may choose not to use taxes and often pursue a less ambitious environmental policy. To illustrate, this section examines the case of the Netherlands unilaterally introducing a carbon tax affecting the energy-intensive part of industry that is subject to international competition. These industries will be refered to as the energy-intensive exposed sectors.

In order to analyze this case, consideration must be given to the following important features of the economic and environmental processes involved:

- First, most empirical studies suggest that the price elasticity of energy use is rather low. This suggests that economizing on energy has become rather expensive.[5]
- Second, and related to the first feature, energy taxes tend to imply a high burden for energy-intensive firms. Regulation imposes costs because it forces industry to cut back pollution to a certain standard. Levies, however, not only induce firms to incur costs to curb pollution but also charge firms for the pollution that remains after the pollution has been cut.
- Third, the exposed sectors supply tradeable commodities that can also be produced abroad. As a result, they experience stiff international competition.
- Fourth, the EC does not allow environmental levies that are levied on the inputs of producers to be refunded at its internal borders. This implies that the Netherlands cannot refund taxes on the inputs of domestic producers when the final goods are exported. Furthermore, it is not allowed to charge a compensating tax on imports of foreign competitors.
- Fifth, the pollution crosses international borders. In fact, the greenhouse effect caused by CO_2 emissions is global in nature. Acid rain is also largely an international problem. In the Netherlands, for example, about three quarters of the depositions of sulpher-dioxide (SO_2) comes from abroad.

The first four of the above-mentioned features imply that unilateral taxes damage the competitive position of the energy-intensive sectors.[6] This reduces the net exports of energy-intensive commodities and, therefore, implies that the production of these commodities is relocated to other countries. Still more production moves abroad when firms cut their domestic investments due to a smaller cash flow and lower expected profitability.[7]

How should we evaluate this scenario of trade diversion and production relocation from an environmental point of view? To begin with, the national emissions of CO_2 decline. However, the production of energy-intensive

goods continues, albeit across the border. Accordingly, it is unclear whether global emissions will fall — which is what ultimately counts. In fact, global emissions may even rise if foreign producers are less energy efficient or if these producers rely more on carbon-rich fuels, such as coal or oil.

This illustrates that national emissions of CO_2 are not always a good yardstick for the environmental impact of particular policies. If a given target for national emissions is achieved without reducing the net exports of energy-intensive commodities, the global environment is much better off than if the same target is achieved by cutting these exports and shifting production abroad. Accordingly, simulations with models of one particular region should provide information not only on regional emissions but also on net exports of energy-intensive commodities — and this in order to better judge the environmental effects.

In a cost-benefit analysis of unilateral policies, careful examination of not only the environmental benefits but also the costs should be made. In this connection, unilateral taxes distort international trade and factor flows. Furthermore, the Netherlands faces serious adjustment problems. In particular, the country loses part of its energy-intensive industry, including the capital, expertise and technology that have been built up through years of learning by doing. These industries exert positive externalities on the rest of the economy as well. For example, they constitute an important part of the economic base for the large collective sector in the Netherlands. Moreover, a major part of the Dutch economy, including part of the sheltered service sector, is dependent on a symbiotic relationship with the energy-intensive industries.

It is questionable whether other, energy-extensive, economic activities will be able to replace the loss of high-quality employment, high value-added activities, expertise, exports, and economic base of the collective sector — even in the medium run. The adjustment issue may be particularly serious in the Netherlands because of a certain lack of flexibility of the Dutch economy.[8] This is due, in part, to the extensive welfare state and its associated market rigidities and distortions. Indeed, there is a real danger that the Dutch economy might turn into a downward spiral if adjustment problems would impair the base of the collective sector.[9]

To conclude then, unilateral taxes that bear on energy-intensive exposed sectors are unattractive. They impose high costs but yield only small or even perverse environmental effects from a global point of veiw. The fundamental cause for this failure is a foreign distortion, namely the fact that environmental costs are not internalized abroad. Accordingly, the Netherlands is confronted with a classical case of the second best. According to the theory of the second best, a reduction of one distortion does not necessarily improve overall welfare as long as other distortions remain. Unilateral taxes are helpful in alleviating one distortion, namely the gap between social and private costs of domestic energy use. At the same time, however, the foreign

distortions remain. In fact, unilateral taxes raise the welfare costs of foreign distortions by shifting the production of energy-intensive goods abroad. Overall, global welfare may be harmed if the foreign distortion exceeds the domestic distortion, while the location of production is rather sensitive to cost differentials.[10]

4. Unilateral Policies Aimed at Exposed Sectors: Other Instruments

This section examines alternative instruments in the context of unilateral policies aimed at energy-intensive exposed sectors, starting with regulation. At first sight, regulation may cause less damage to the competitive position of the energy-intensive sectors because, in contrast to levies, regulation does not charge for the pollution that remains over and above a certain norm.

However, regulation is beset with a number of major disadvantages. Most importantly, it tends to provide less flexibility to the private sector in deciding how and when to curb pollution. This is especially serious for energy-intensive firms because they typically use complex processes. Moreover, the costs of curbing pollution tend to vary substantially across the various polluting sources. It is next to impossible to attune regulation to these differences. Furthermore, regulation tends to protect existing firms, as it acts as a barrier to entry. In this way, it may inhibit the free functioning of markets as well as technological change. Finally, regulation may be difficult to enforce.

As far as unilateral policies are concerned, subsidies, in combination with agreements with industry, may be the most promising instrument. Such a policy package imposes less distortions in international trade- and factor flows. In addition, it actually contributes to curbing global emissions. To wit, it not only encourages domestic producers to shift to a cleaner production process, but also keeps up net exports of energy-intensive commodities. Furthermore, the adjustment problems facing the Dutch economy are less severe under subsidies. The reason is that the costs are spread out over the entire economy. The collective financing also, however, points to a major disadvantage of subsidies. Instead of the pollutor, the rest of the economy pays — namely, through the distortionary taxes that are required to finance the subsidies. The marginal efficiency costs of additional taxation tend to be especially high in countries with high tax burdens, such as the Netherlands. Subsidies suffer from other drawbacks as well. To illustrate, subsidies for selected technologies may give an artificial advantage to particular ways to conserve energy over other, perhaps more efficient, ways. Furthermore, trading partners may perceive subsidies as unfair competition. Indeed, subsidies may give rise to an international 'subsidy war.' Moreover, they may expand the government bureaucracy. If subsidies are not accompanied by regulations or agreements that raise costs, they may actually encourage firms to enter the polluting sectors and distort the international allocation of

energy-intensive firms by attracting energy-intensive firms from countries with stiffer rules and less generous subsidies. Overall, subsidies are "second-best" instruments in case international coordination is not forthcoming.

There seems little scope for unilateral policies aimed at exposed sectors. The fundamental cause is the international mobility of not only pollution, but also commodities and capital.

5. International Coordination

International coordination is therefore preferable to unilateral policies, especially if they concern exposed sectors. This section examines the case of international coordination more closely. With coordination, taxes are more attractive than without coordination because taxes shift energy-intensive production abroad only if foreign production causes less pollution. Nevertheless, even if coordination is forthcoming, some conditions have to be met in order for the tax instrument to be truly successful.

First, the market imperfections that impede the allocative effects of taxes should be eliminated as much as possible. Indeed, supplementary measures are often required to ensure that taxes actually affect behavior. Supplying information, for example, may raise the elasticities that determine the behavioral impact.

A second condition for the success of the market-oriented instrument of taxation is an efficient and flexible functioning of the economy and markets. More generally, a well-functioning market mechanism is a powerful instrument to efficiently allocate scarce environmental resources and to efficiently deal with the adverse supply shock of a higher price for environmental capital. Indeed, the Ministry of the Environment and the Ministry of Economic Affairs should be close allies in striving to improve the functioning of markets. To the extent that they are less successful in accomplishing this, they face the danger that an ambitious environmental policy would give rise to serious adjustment problems. This would most likely erode both the economic and political support for strict environmental policies.

In the context of the Dutch economy, an important priority in this respect should be the reduction of the high burden of taxes and social security premiums. In the Netherlands, this burden is called the collective burden. A reduction of this burden would amount to an important investment in the functioning of the domestic economy. Accordingly, the revenues from environmental taxes should be used to reduce taxes that distort markets.

The government may have to go further, in fact, and cut public spending in order to reduce the overall (measured) collective burden by cutting public spending. This is especially so if environmental levies yield large environmental benefits by producing large behavioral effects. The reasoning is as follows.[11] If the government wants to maintain its total tax revenue, it will not be able to compensate the costs private agents incur in curbing pollution.

Hence, the "hidden" collective burden rises as environmental taxes explicitly aim at changing private behavior for the public good of a cleaner environment. In an open economy in which capital is rather mobile internationally, most of the costs of a cleaner environment will be borne by labor in the form of lower real wages. This reduces the incentive to supply labor, thereby reducing employment. Without labor market distortions, the higher "hidden" collective burden and fall in employment associated with this application of the pollutor-pays principle would unambiguously improve welfare. However, in a distorted economy, employment may be suboptimal. In that case, environmental taxes tend to worsen labor market distortions by reducing employment — especially if one aims at protecting the lowest incomes.[12] Indeed, a higher priority for the collective good of the environment makes the task of pruning the welfare state and lowering the overall collective burden more, rather than less, urgent. The political pressure to cut spending and reform the labor market, however, may well decline because it is politically less costly to increase taxes on a bad thing like pollution than to raise taxes that directly bear on labor. To summarize, pollution taxes yield a double dividend, namely a cleaner environment and a more efficient labor market, only under stringent conditions.[13] Intuitively, if one aims at two objectives, one needs at least two instruments. One is a different tax mix with a larger role for environmental taxes. The second instrument is a lower collective burden.

In this connection, the Netherlands should avoid the mistakes it made in the seventies when the actions of OPEC allowed the Dutch government to impose a weighty implicit energy tax. In particular, the windfalls from the higher revenues from natural gas were appropriated by the government and used to expand the welfare state rather than to reduce taxes and social security premiums. This contributed to what has become known as the "Dutch disease."[14]

Another condition for a successful implementation of taxes in the Netherlands is that the country develop new strong comparative advantages and expertise. This is because the Dutch economy, at the moment, relies rather heavily on energy-intensive firms as the basis for its exports and its collective sector.

Furthermore, international coordination must be enforced. In fact, this is an under-rated issue because the world faces a rather serious free-rider problem. No individual country, on its own, has a strong incentive to actually collect the tax. It would be very difficult to check whether sovereign nations indeed charge high taxes to the exposed sectors that provide major benefits to their countries. Another problem is that the quality of tax administrations and the possibilities for tax evasion differ substantially across countries.[15]

In this connection, it is worth noting that energy markets belong to the most regulated markets.[16] Therefore, the allocative effects of the tax instrument in any particular country should be judged in conjunction with other

interventions in energy markets, such as regulation, subsidies, and other taxes on fossil fuels. In particular, countries should not use these interventions to offset the allocative effects of the coordinated levy. In fact, an important first step towards a cleaner environment is to abolish the interventions that encourage rather than discourage pollution, such as subsidies for coal mining and low VAT and excises on energy.

To summarize, taxes can, in principle, play a major role within the framework of an internationally coordinated policy. However, some complementary measures are needed to address some complications. Furthermore, there remains a role for other environmental-policy instruments, such as subsidies that are aimed at specific market imperfections. To illustrate, the collective, non-rival, character of knowledge may call for subsidies for research and development of new technologies, which are essential to cut pollution. However, one should be careful in using subsidies. In particular, one must consider not only market imperfections but also government failures that are associated with bureaucracy, financing costs, and a lack of information.

6. Households and Sheltered Sectors

As far as firms that are not exposed to international competition (the "sheltered" sectors) and households are concerned, the international relocation of production is less of a threat. Is the tax instrument here the main dish — even if international coordination is not possible? In order to judge this, this section first examines a few complications of unilateral taxes — starting with some international aspects.

The Netherlands is bound by EC agreements on indirect taxation. Even if unilateral taxes are formally allowed, coordination may still be required. This is in order to prevent widespread cross-border shopping in an internal market without any border controls. Indeed, in the Netherlands about 30 percent of the population lives within 30 km of the border. In Europe as a whole, this figure is only 15 percent. In the internal market, individuals are allowed to acquire fossil fuels directly from foreign distributors without paying Dutch indirect taxes. This cross-border shopping may involve not only gasoline (petrol) but also other fuels (such as LPG, heating oil). Moreover, if price differences are substantial, firms will also be tempted to buy some of their energy supplies across the border. Tax authorities may be able to prevent this tax evasion only by employing a large bureaucracy and at great costs to corporations and free trade alike. Indeed, a small open economy like the Netherlands will most likely be forced to exempt energy sources that can be easily transported across borders. These relatively cheap sources will then spread like an oil slick over the economy. The reason is that the relatively cheap fuels will be substituted for the energy sources that are taxed relatively heavily.

Another complication of a tax on the sheltered sector is that, in practice, it will be difficult to distinguish the sheltered from the exposed sector. This distinction, in fact, may make the tax structure complex, result in tax evasion, and impose high administrative costs on firms. Furthermore, it may be difficult to separately identify the CO_2 emissions embodied in electricity generated for the sheltered and exposed sectors. Moreover, the tax discrimination against the sheltered sector may cause serious distortions within the domestic economy. For example, a regressive tariff structure aimed at protecting large energy-intensive industries may act as a barrier to entry and harm young dynamic firms. More generally, the protection of existing firms hampers competition and may well damage the flexibility of the economy.

Another important issue regarding the household and sheltered sectors concerns the existence of several major market imperfections.[17] Rent regulations, for example, may prevent landlords from retrieving from their renters the costs of energy-conservation measures. Other market imperfections involve high transaction costs, separation of benefits from costs (the so-called "tenant-landlord" problem), a lack of information, imperfect capital- and insurance markets, and a short time horizon. Furthermore, governments tend to regulate the fuel mix for generating electric power. Indeed, the key decisions affecting fuel choice lie with the government rather than with households.

In the sheltered sectors, market and competitive mechanisms are often quite weak because these sectors are protected from foreign competition. Moreover, the public sector constitutes an important part of the sheltered sector. Here, political and bureaucratic forces rather than economic pressures may be dominant. Time horizons, for instance, may be quite short due to cash-flow constraints and short-term budgeting.

In some cases, the best solution is simply to alleviate market imperfections in the household and sheltered sectors, for example by reducing transaction costs, removing rent regulations, improving the functioning of capital markets, etc. However, this may not always be possible — especially not in the short- or medium-run. In that case, environmental policy has to take these imperfections into account. The major point here is that market imperfections tend to limit the allocative and behavioral effects of taxes so that taxes tend to act largely as an ordinary revenue measure with only very small effects on the composition of consumption and, thus, on the environment.[18]

In order to substantially reduce pollution, therefore, one has to resort to alternative instruments. In particular, regulation is generally a rather attractive instrument to affect household behavior. The reason is that households typically use rather simple and uniform processes. Hence, the government possesses enough information to regulate these processes rather efficiently. It may use building regulations, for example, to set standards for home insulation. The government may also set standards for electric appliances, lighting, and boilers. However, international coordination may be required if it

concerns traded commodities. Furthermore, one should ensure that regulation does not foster market rigidities.

In most cases, subsidies for households seem to be rather less attractive. These subsidies typically require a substantial effort on the part of the government in view of the large number of households. Moreover, only the well-informed households may be reached, those which might have already curbed pollution even if the subsidy would not have been provided (the so-called "Matheus-effect"). Furthermore, the collective financing of subsidies may damage the competitive position of exposed sectors.

7. Conclusions

At first sight, taxes may seem by far the most attractive instrument for cutting pollution. However, a closer look reveals that taxes involve a number of major complications — especially in an open economy riddled with market imperfections. In practice, therefore, a wide-ranging policy mix is called for. Indeed, a diversified diet is most healthy. The main dish depends on the specific situation. Taxes can be a major component of an internationally coordinated policy. However, if coordination is not forthcoming, the combination of subsidies and agreements with industry would seem to be the main dish — at least if the policy is aimed at exposed sectors that are energy intensive. As far as households and sheltered sectors are concerned, regulation can continue to play a major role. A final conclusion is that entrées that are coordinated internationally taste a lot better than dishes that are served in an uncoordinated fashion.

Notes

[1] This paper was prepared for a conference on "Energy Taxation in Europe" organized by the Stichting voor Economisch Onderzoek (SEO) and held on December 13, 1991 in Amsterdam, the Netherlands. The author would like to thank Sijbren Cnossen, Jarig van Sinderen and one anonymous referee for helpful comments on an earlier draft.

[2] In the Netherlands, however, a different fuel mix does not offer much scope for reducing CO_2 emissions, as this country already relies mostly on natural gas, which is relatively clean. For the distinction between energy taxes and carbon taxes, see Cnossen and Vollebergh (1991).

[3] See, for example, Bohm and Russell (1985).

[4] See, for example, Baumol and Oates (1988) and Pearce and Turner (1990).

[5] In the long run, the price elasticity is likely to be higher, especially if changes in energy prices are expected to last. One of the major reasons is that the anticipation of high energy prices will affect the direction and speed of technological change.

[6] By using the revenues from the taxes to reduce other taxes, the government may be able to alleviate a small part of the adverse effects of the higher energy levies on the competitive position of the energy-intensive sectors. However, lower taxes on capital or labor will not be able to fully compensate the energy-intensive sectors in view of their energy intensity, which is much higher than that of the rest of the economy.

[7] In the context of the United Kingdom, Freeman (1991) investigates the effects of a uni-

lateral carbon tax on the competitive position of energy-intensive manufacturing. Furthermore, Herzberg and Minne (1992) examine how a 50 or 100 percent tax on the cost of energy levied in either the whole OECD or in the Netherlands only would affect the location of energy-intensive forms. The estimates for the losses in employment, output, and exports were used as an input in a multi-sector model of the Netherlands. For the macro-economic and sectoral effects of these taxes for the Dutch economy, see Centraal Planbureau (1992).

[8] For a description of the salient features of the Dutch economy in general and the rigidities and inflexibilities, in particular, see, e.g., OECD (1989), OECD (1990), and European Commission (1990).

[9] Market rigidities, the welfare state, and external effects due to learning by doing are typically lacking in the models that economists use to advocate taxes as the best policy instrument.

[10] In fact, the OECD concluded in a recent country report on the Netherlands: " 'Go-it-alone' policies in the domain of CO_2 emission are extremely costly and largely ineffective" (see OECD (1990), p. 67).

[11] For a more elaborate explanation, see Bovenberg and Cnossen (1991) and Bovenberg and de Mooij (1992). For the design of environmental policy in a second-best world, see also Baumol and Schwab (1988) and Sandmo (1975).

[12] See, for example, Goulder (1991).

[13] These conditions include, first, small behavioral effects and, therefore, small environmental effects and second, a sacrifice in terms of income equality, namely a reduction in the real purchasing power of low incomes. For this latter condition, see also Pearson and Smith (1991).

[14] Natural gas revenues continue to play an important role in the Dutch budget. Hence, the consequences of coordination taxes for the price of fossil fuels on world markets are important indeed. In this connection, the response of the OPEC-cartel is crucial.

[15] Another major problematic issue in this respect is the inclusion of the LDCs in an international agreement. Enforcing taxes in these countries is likely to be very difficult.

[16] Helm (1991) surveys several important market imperfections in energy-markets.

[17] See also Jackson and Jacobs (1991).

[18] For the relationship between market imperfections and the price elasticity of energy use, see Jackson and Jacobs (1991). They stress the importance of policy measures aimed at improving the efficiency of the market.

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